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An Exploration Model for A Gold Deposit in Kervian Area, Kurdistan Province, Iran, using a Combination of Geophysical Results with Geological Information and Other Exploratory Data

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Abstract

As many gold deposits are associated with sulfide zones, and the direct exploration of gold deposits using the geophysical methods is very difficult due to its low amount in the sub-surface, the direct exploration of sulfide zones by the geophysical electrical resistivity and induced polarization (IP) methods may lead to the indirect exploration of gold deposits. The gold deposit in the Kervian area is located in the Kurdistan shear zone, and is directly related to the sulfide, silica, and carbonate alteration units. After acquiring the resistivity and IP data, 2D modeling of the data is made in order to indirectly identify the gold-bearing zones in the surveyed area. As some of the identified geophysical anomalies indicating the sulfide zones may not be associated with the economic amounts of gold, in order to obtain an exploration pattern for the gold deposit in the studied area, a combination of the geophysical data modeling and interpretation results with the geological information and other exploratory data is used to reduce the uncertainty in identifying the gold-bearing zones in the studied area. Thus, modeling and interpretation of the geophysical data lead to identify the sub-surface anomalies as the locations of possible gold mineralization in the area, and then the drilling points are suggested in the area. Considering the geological studies and chemical analysis of the samples taken from the drilled boreholes crossing some of the geophysical anomalies, we conclude that the geophysical anomalies occurring inside the phyllite and carbonate units in the area can contain an economic amount of gold, and thus are recommended as the top priority for further exploration.

1. Introduction

Many gold mines and deposits are associated with sulfide zones or minerals. In search for sulfides, gold may also be found [1]. According to Hannington *et al.* (1999), nearly 5% of massive sulfide deposits worldwide accompany the mineable gold, and some of the most valuable gold deposits have been identified while the exploration of base metals has been the main task [2]. Gold mineralization or deposit, depending on the conditions and deposit type, is usually economic at the limit of a few grams per ton. Considering this point, the direct exploration of a gold deposit using the geophysical methods is very difficult as its amount in the sub-surface is small compared to the other minerals. In other words, obtaining a direct geophysical indication of gold is almost impossible due to the low grades of gold in the gold deposits. However, we may have indirect geophysical indications of gold as it is associated with certain host rocks, markers or structures; for instance, gold deposits may have an unusual density, magnetization, electric polarization or resistivity/conductivity. Among the unusual markers for gold deposits, magnetic dolerites, banded iron formations, shales with magnetite, conductive and/or polarizable pyrites or other sulfide and silicified zones can be mentioned [3]. As a result, the only way for gold exploration using the geophysical methods is carried out indirectly. Hence, exploration of the gold deposits associated with sulfides is done indirectly by identifying the paragenesis sulfide minerals

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accompanying the gold. The main geophysical methods that can be used for exploration of sulfide deposits are the geo-electrical resistivity and induced polarization (IP) methods. Among the previous geophysical works that have been carried out to explore gold in different areas, we can mention the use of electrical resistivity, IP, magnetic, very low frequency (VLF) electromagnetic, and horizontal loop electromagnetic (HLEM) methods, for example, to explore gold in the Lapland green stone belt in the volcanic and sedimentary rocks in the Iso-Kuotko area, Finland [4]. Another case study is to explore gold and silver deposit in the Julietta area located on the Okhotsk-Chukotka belt in Russia by the IP method [5]. Sultan *et al*. (2009) have carried out geophysical exploration of gold and associated minerals in the Wadi El Beiden area in the South Eastern Desert of Egypt [6].

Gold deposits of shear zone type are one of the notable sources of gold deposits in the world. Identifying the faults and shear zones in which gold may exist is also very beneficial [3]. In Iran, gold deposits of shear zone type are located on the metamorphic parts of the Sanandaj-Sirjan zone and in the Kurdistan Province. The Alut area is situated in NW of the Sanandaj-Sirjan zone in the Kurdistan shear zone, in which a significant number of gold deposits have been identified. The gold deposit in the Kervian area is situated in NW of the Sanandaj-Sirjan zone and SW of the city of Saqez. The concentration of gold mineralization in the Kurdistan shear zone is directly related to the sulfide, silica, and carbonate alteration units. The indicative minerals of sulfide zone are mainly pyrite, arsenopyrite, free gold, and in a small amount, chalcopyrite. Thus identifying the sulfide zone in the studied area is an appropriate aim for IP studies. Considering the observed evidences of mineralization in the Kervian area, after collecting the resistivity and IP data using the dipole-dipole electrode array, 2D modeling and interpretation of the data were made in order to identify the gold mineralization zones in the surveyed area. The results of 2D modeling and interpretation of the acquired resistivity and IP data are presented and discussed in this paper. The acquisition of the resistivity and IP data was made along three survey lines in the studied area, although in order to avoid a lengthy paper, we presented here the results of 2D modeling and interpretation of the acquired data along only two survey lines in the area. Generally, mineral exploration is a multi-disciplinary task in which the simultaneous combination of various geophysical, geological, geochemical, and other exploratory data should be considered [7]. Hence, to obtain an exploration pattern or model for the gold deposit in the Kervian area of Kurdistan Province, a combination of the geophysical data modeling and interpretation findings with geological information and other exploratory data is used, and the results obtained are presented.

2. Methodology

Gold with a density of 19.3 g/cm^3 and an electrical conductivity of 5×10^7 Siemens/m seems to be a good geophysical target for detection but due to having a very low grade (few grams in ton), it is difficult to be detected directly by the geophysical methods. However, the indirect geophysical detection of gold is often made successfully; for instance, high electrical conductivity of gold deposits can be due to the combination of gold with pyrite and chalcopyrite or its high magnetism can be attributed to gold coexistence with pyrrhotite or magnetite or it can be associated with certain host rocks, marker layers or structures. Thus, these indirect geophysical characteristics of gold can be good guides for its geophysical exploration by the resistivity, IP, magnetic, magnetic induced polarization (MIP), and electromagnetic (EM) methods. The resistivity patterns can indicate an alteration in gold deposits. The magnetic permeability of the samples taken from cores can be used to determine the level of alteration. Where gold is directly linked to bell pyrite, the magnetic skarn or massive sulfide, magnetic, and electromagnetic methods can be used. A combination of gold and iron sulfides like pyrite plays an important role in creating high IP values [3].

Considering the geological reports and the observed evidences of mineralization in the Kervian area, the IP and resistivity data along three survey lines (shown by the turquoise-colored lines in Figure 1) using the dipole-dipole electrode configuration with electrode spacing of 30 m were acquired by a geophysical team from the Shahrood University of Technology in 2016. Due to the fact that the effect of electromagnetic coupling in the dipole-dipole array is the lowest compared to the other electrode arrays, and electrical data obtained using this array have a relatively good horizontal coverage and resolution, the dipole-dipole array was used for the electrical surveys in this research work. Of course, the signal-to-noise ratio is not the highest in this array; considering the maximum depth of investigation, and also the appropriate resolution of this electrode array, the electrode spacing (that is usually shown by a) of 30 m was applied. The maximum number of separation steps (separation of dipoles), shown by n, was considered to be eight (i.e. n = 1, 2, ... , 8). This is because at steps above eight, the signal-to-noise ratio is considerably reduced.

In this paper, only the results of the IP and resistivity data modeling and interpretation along two survey lines, called the KTA and KTC survey lines, have been shown. For modeling and interpretation of the IP and resistivity data, the RES2DINV software was used. 2D modeling and interpretation of the IP and resistivity data were made in order to identify the gold mineralization zones in the studied area. The results of the IP and resistivity data inversion and interpretation were compared and then combined with the geological information and exploratory borehole data in the area to get a more accurate and reliable picture of the gold mineralization in the sub-surface.

3. Geology of studied area

Figure 1 demonstrates a geological map of the Kervian area at a scale of 1:20,000. The tectonic features such as faults are also demonstrated on this geological map, which has been prepared by Korei *et al*. (2000).

This geological map is used as a basic tool for the purpose of gold exploration in the area. Since tectonics has been so active in the entire region enclosing the studied area, the initial stratigraphic relations have been disrupted by its performance. In general, the outcropped deposits in the area can be divided into the two main sedimentary and igneous parts, both of which have been transformed into the green schist facies (Figure 1).

Sedimentary deposits include carbonate in the form of limestone, metamorphic dolomite, and peltic sediments that have been metamorphosed into phyllite. The igneous rock assemblage consists of the volcanic and intrusive rocks that have a dual combination of acidic and alkaline, which have become schists.

The fault in the region can be divided into several types. The most important faults in the region are the thrust faults, which have made the repetition of lithological units. It is very difficult to detect these types of faults in the volcanic mylonite units due to their being parallel and the same slope with the predominant mylonite foliages. However, in the areas where there is also a sedimentary assemblage, it is possible to detect the repetition of various lithological units [13].

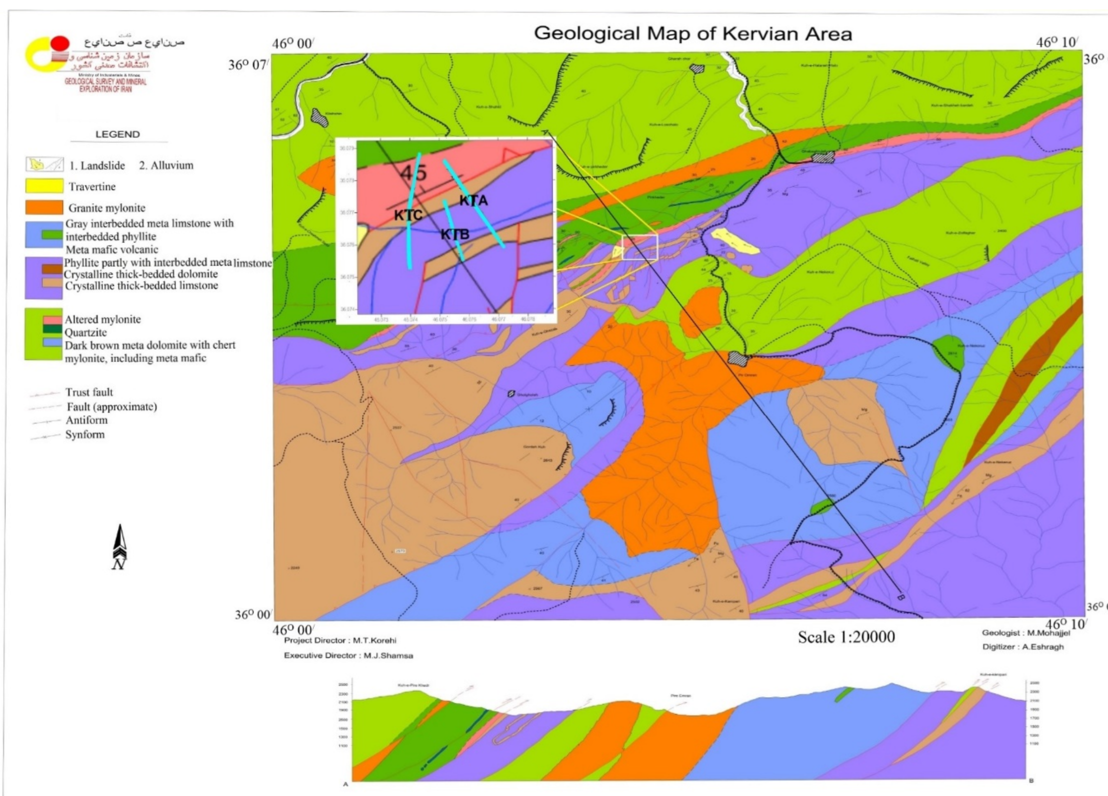

Figure 1. Geological map of the Kervian area at a scale 1:20,000 [14], and location of the geophysical survey lines in the area. The turquoise-colored lines show the positions of the geophysical survey lines on the geological map.

Gold mineralization in the Kervian area can be observed in the two forms of vein/veinlet and disseminated mineralization. Inside the siliceous units with varying thicknesses (1-2 cm to several m), the mineralization is seen in the form of laminates and veins parallel to the spread of mylonite units but in highly silicized wall stones, the mineralization appears to be disseminated.

Investigation of the relationship between the results of assay analysis of the samples taken from the trenches in the metamorphic and mineralized zones with different rock units indicates a strong correlation between the high grades of gold with highly deformed units (mylonite, ultramylonite) and altered (siliceous, sulfide-carbonate) and metamorphosed volcanic (acidic) units. Thus a very close spatial relationship can be found between the hydrothermal alteration with ductile shear deformation and mineralization [13]. In general, mineralization occurs in the faulted, deformed, altered, and metamorphosed rock units, where tectonics has played a significant role and has affected the mineralization in the area.

In the last few years, various studies have been conducted by the Gold Exploration Division of the Geological Survey of Iran for gold exploration in the Kervian area, some of which have led to detailed exploration and supplementary studies. General exploratory studies up to 2001 in the Saqez area led to the introduction of gold anomalies in the Kervian and Gholgholeh areas. In the fall of 2001, the excavation of seven trenches with a total length of 500 m and the extraction of 138 samples from it led to the identification of seven veins in the Kervian area. The assay studies of the samples taken from this area indicated that the gold concentration in some of the samples exceeded 1 ppm. In the spring and summer 2004, 12 exploratory boreholes were drilled with a total length of 2100 m, and 5 additional trenches were drilled with a total length of 460 m [13].

4. Geophysical data modeling and interpretation results

One of the important issues in the quantitative interpretation of geophysical data is the inversion of the data. Consequently, an earth model defined by its physical and geometric parameters is obtained, in which the quantitative values are assigned to the parameters. The aim of inversion is to estimate these quantities or values using the collected data [8]. The RES2DINV software, which is used for the data inversion in this research work, is a computer program that generates a 2D (based on a rectangular blocks) model of the data obtained from the electrical imaging method. This software uses a simple prototype in order to generate the 2D resistivity and IP models. However, in order to achieve a better model, the inversion parameters such as the damping factor, horizontal and vertical flatness filters or vertical to horizontal flatness filter ratio, and the weights of these parameters should be defined. The damping factor and flatness filters can be adjusted to suit different types of data. In the RES2DINV software, we have a set of pre-defined values for the damping factors and other parameters that normally give satisfactory results for most datasets. However, in some occasions, better results may be obtained by adjusting the parameters that control the inversion process. If the dataset is very noisy, a relatively higher damping factor (for instance 0.3) may be applied. If the dataset is less noisy, a lower initial damping factor (for instance 0.1) is used. The inversion program will generally decrease the damping factor after each iteration. However, a minimum value for the damping factor must be determined for the stabilization of the inversion. This minimum value should usually set to nearly one-fifth of the initial damping factor. Based on the above explanation, the value of 0.1 was considered for the initial damping factor in this research work. For the vertical to horizontal flatness filter ratio, if the anomalies in the pseudo-section are extended vertically, the inversion program should be forced to create the models that are also extended vertically by setting a larger value (for instance 2.0) for the ratio of the vertical to horizontal flatness filter. For the anomalies that are extended horizontally, a lower limit (for example 0.5) is selected for the ratio of the vertical to horizontal flatness filter. In this research work, the value of 1.0 was considered for the ratio of the vertical to horizontal flatness filter. The RES2DINV program allows one to fix the resistivity of different parts of the subsurface. If we apply a damping factor weight of 1.0, the resistivity of the sub-surface zone is permitted to change to the same extent as the other sub-surface zones of the model. If we use a higher damping factor weight, the change permitted in the resistivity of the fixed zone will be lower; we usually use a value of about 1.5 to 2.5. If we use a relatively large value, for instance 10.0, the change in the resistivity of the zone will be very small during the inversion process. We use such a large value only when the resistivity and shape of the zone is quite known. As we did not fix the resistivity of any parts or region in the sub-surface, no damping factor weight was required in the inversion process. The shape or topography of the earth surface can produce the local anomalies, which can confuse us or can cause to mistakenly take the anomalies associated with mineralization. In the RES2DINV software, there are multiple options to enter the resistivity and IP data measured at ground points or stations containing topography. The smooth inverse modeling by the RES2DINV software is carried out using the least squares method with direct smoothing to the inversion process. Many studies have been done on resistivity and IP data modeling and interpretation with or without taking the topography of the ground surface at the locations of the survey lines where the resistivity and IP data measurements are made [e.g. 9-11].

The results of the IP and resistivity data modeling and interpretation along the KTA and KTC survey lines have been presented and discussed in the following.

4.1. KTA survey line

Figures 2 and 3, respectively, demonstrate the results of inverse modeling of resistivity and IP data with topography along the KTA survey line made using the RES2DINV software. As it can be seen from the resistivity and IP cross sections, shown in Figures 2 and 3, three possible anomalies can be found on the KTA survey line. The possible anomaly A is located between 60 m and 120 m from the beginning of the survey line at a depth of approximately 15-20 m. As the geological cross-section of this survey line (shown in Figure 4) implies, this anomaly is located at the phyllite border with the limestone layer. The maximum modelled chargeability value for anomaly A is 700 milliseconds, which is observed at a distance of 60 m from the starting point of the survey line in the depth of 15 m. According to Figure 2, the range of modelled resistivity variations for this anomaly is 215-2000 ohm-m. The possible anomaly B is situated between 165 m and 330 m from the beginning of the survey line at the approximate depth of 20 m downward. The maximum modelled chargeability value for this anomaly is about 700 milliseconds, which can be seen at a distance of 250 m from the beginning of the survey line in the depth of approximately 60 m. The geological cross-section of this survey line (shown in Figure 4) indicates that this anomaly is mainly located in the phyllite units with limestone layers and small portion of this anomaly located within the alterations occurring in the lithological units. The possible anomaly C is a small-size superficial anomaly, which is located between 330 m and 360 m from the starting point of the KTA survey line, and it begins from the ground surface to the depth of about 14 m. The maximum modelled chargeability value for this anomaly is about 550 milliseconds that it is visible in the surface at a distance of 292 m from the beginning of the survey line. Considering the geological cross-section of this survey line (shown in Figure 4), this anomaly is observed in the altrated mylonite. The modelled resistivity values of this anomaly are relatively high (1000 to 4000 ohm-m). The main reason for the high resistivity values of this anomaly, located in the mylonite units, is the kind of mylonite and alterations occurring in these units. It should be mentioned that the main alteration in these units is silica, which causes the resistivity to be increased. Moreover, according to the geology of the area [12], a thrust fault occur in the boundary of thick crystalline limestone layer and the altered mylonite, and as the resistivity variations in these two layers is very low, and thus it is very difficult to detect the fault location from the resistivity data. According to the results of inverse modeling of the resistivity and IP data with topography along this survey line, two drilling points are suggested (Figure 3). As indicated in this figure, the first drilling point is located at a distance of about 70 m from the beginning of the survey line, and the second drilling point is located at a distance of about 300 m away from the starting point of the survey line.

Figure 4 indicates the geological cross-section along the KTA survey line passing the BH-KTA borehole that has been obtained from the 1: 20,000 geological map of the studied area. In this geological cross-section, the geophysical anomalies A and B (Figures 2 and 3) along the KTA survey line are also shown. This Figure demonstrates the approximate lateral and depth extensions of the geophysical anomalies A and B in the underground geological layers to obtain a better concept or understanding of the sub-surface anomalies containing gold potentially and perhaps practically.

In order to validate the models obtained for the KTA survey line, after a careful study of the analysis results of the samples taken from different depths of the BH-KTA borehole, the chart of variations in the gold element concentration (in terms of ppm) versus the depth in this borehole was drawn (Figure 5). This borehole is located at a distance of 120 m away from the beginning of the KTA survey line. According to Figure 4, the borehole crosses the possible anomaly A at a depth of approximately 40-60 m below the ground surface, and according to Figure 5, the presence of a considerable amount of gold in this anomaly is confirmed.

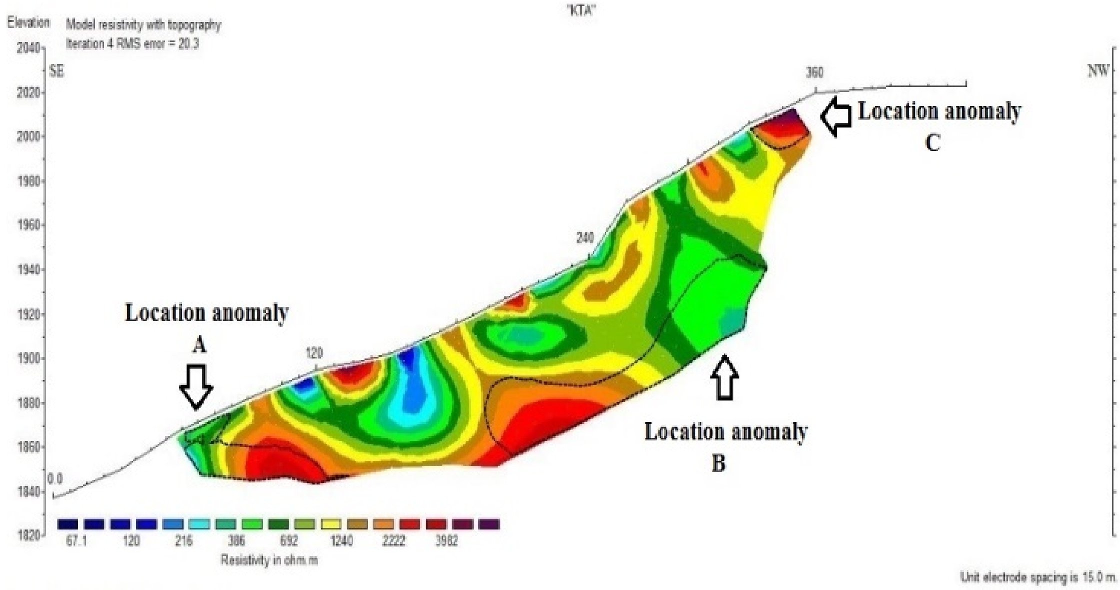

Figure 2. Resistivity cross-section obtained as a result of the inversion of resistivity data with topography along the KTA survey line.

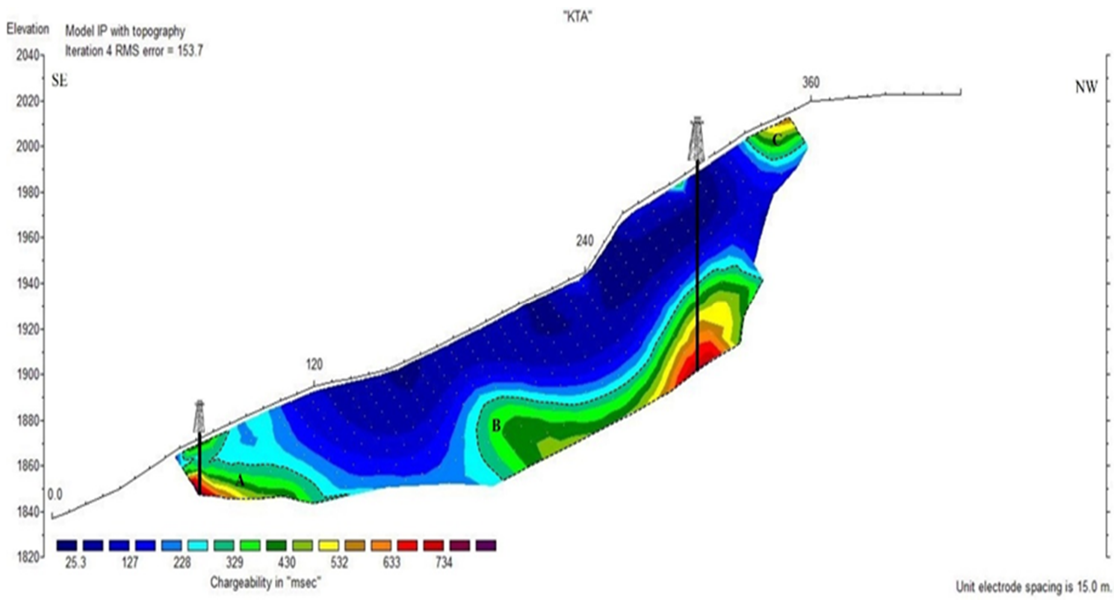

Figure 3. IP cross-section obtained as a result of the inversion of chargeability data with topography along the KTA survey line and suggested boreholes to access mineralization.

4.2. KTC survey line

Figures 6 and 7, respectively, demonstrate the results of inverse modeling of resistivity and IP data with topography along the KTC survey line using the RES2DINV software. As it can be seen from the resistivity and IP cross-sections, shown in Figures 6 and 7, four possible anomalies can be found on the KTC survey line. The first possible anomaly is anomaly F, which is located at a distance of 37 m to 75 m from the beginning of the KTC survey line (Figures 6 and 7). This anomaly with high chargeability values is located in the ground surface up to the depth of approximately 30 m below the ground surface. High chargeability values of this anomaly are attributed to the pyrite mineral particles, which also exist on the ground surface. According to Figure 6, the modelled resistivity values of this anomaly are about 600 to 1500 ohm-m. The anomaly F is situated in the phyllite units and limestone layers. The second possible anomaly is anomaly G, which is located at a distance of approximately 105 m to 120 m from the starting point of the KTC survey line. This anomaly is situated at the ground surface up to a shallow depth of about 10 m. The amount of modelled resistivity variations in this anomaly is about 400 to more than 1000 ohm-m. The modelled chargeability values for the anomaly G vary from 300 to 700 milliseconds. In terms of lithology, this anomaly is also found within the phyllite units near the limestone layers. The third possible anomaly is anomaly H, which is situated between 140 m and 195 m from the beginning of the survey line. The anomaly H starts at a depth of approximately 20 m below the ground surface, and is extended up to a depth of approximately 74 m below the ground surface. The maximum modelled chargeability values for this anomaly are approximately 400 to 700 milliseconds. The modelled values of the resistivity variations in this anomaly is about 250 to 2000 ohm-m. A part of the anomaly H is inside the phyllite units, and the other parts are inside the thick limestone layer. The last possible anomaly along the KTC survey line is anomaly I, i.e. the largest anomaly among other anomalies along this survey line. This anomaly is extended from a distance of 260 m from the beginning of the KTC survey line up to the end of the survey line, and its outcrop is also observed from the distance of approximately 320 m to the end of the survey line. The maximum modelled chargeability value for the anomaly I is about 700-800 milliseconds. The high chargeability values of this anomaly are due to the presence of metallic mineral particles such as pyrite. The modelled resistivity values of this anomaly change from about 200 ohm-m (on the ground surface and shallow parts) to more than 2200 ohm-m (in deeper parts). In terms of lithology, as it can be seen in Figure 8, the anomaly I is located in the mylonite units. Considering the existence of the fractures in this anomaly, which are more on the ground surface than in the depth, the low resistivity values of this anomaly on the ground surface can be justified. At a distance of 220 m along the survey line, there is a thrust fault. The resistivity variations in two sides of the fault are very low, which cause the detection of the fault from the resistivity model to be very difficult. According to the IP and resistivity modeling results (Figures 6 and 7), we can suggest 3 drilling locations at the distances of 60 m, 165 m, and 325 m along the KTC survey line (see Figure 7).

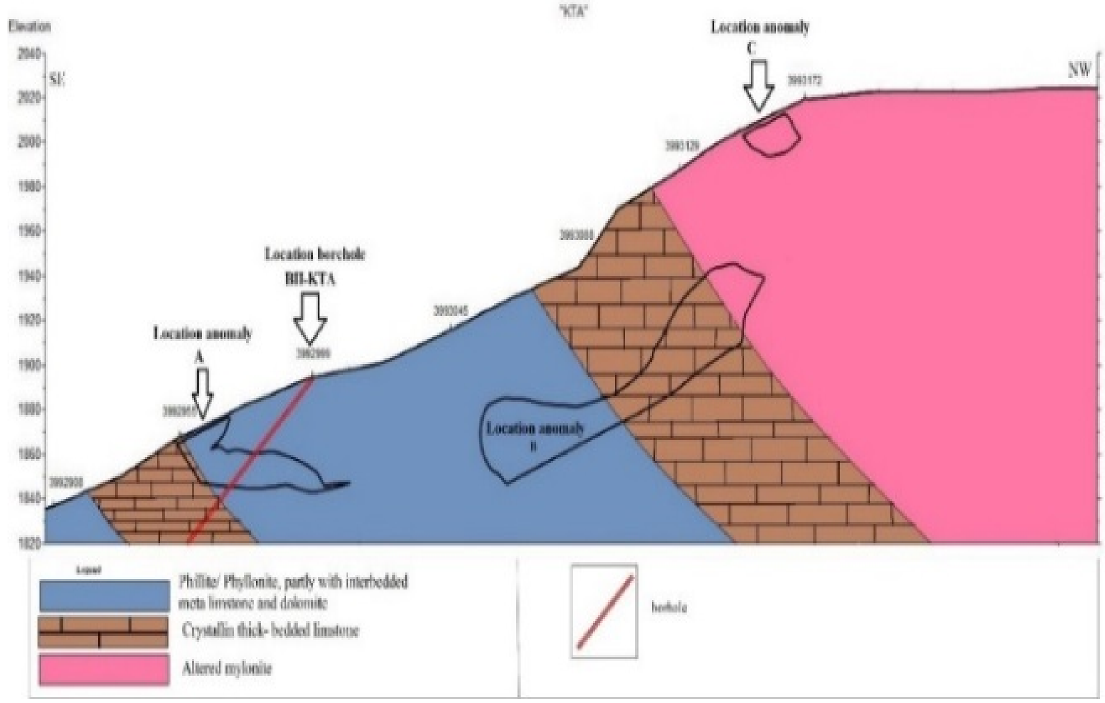

Figure 4. Geological cross-section along the KTA survey line and the BH-KTA borehole position.

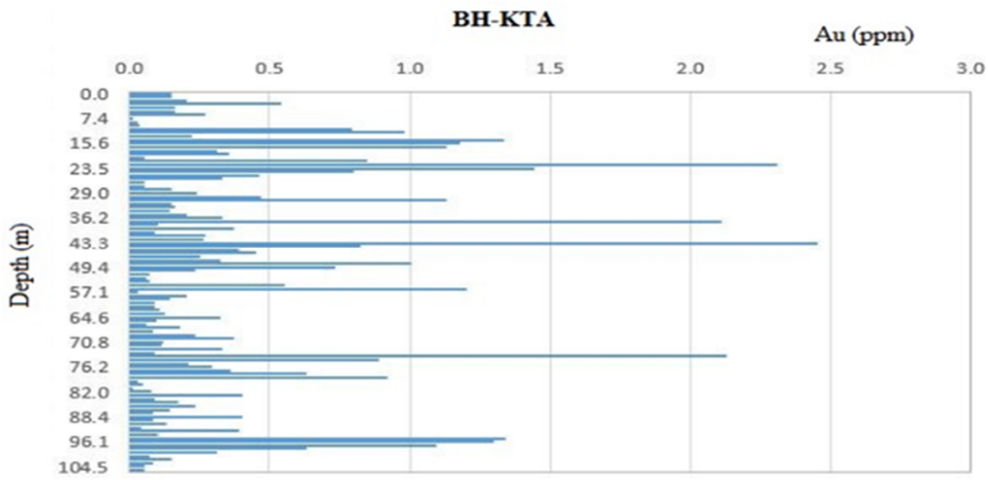

Figure 5. Variations in gold element concentration versus depth in the BH-KTA borehole.

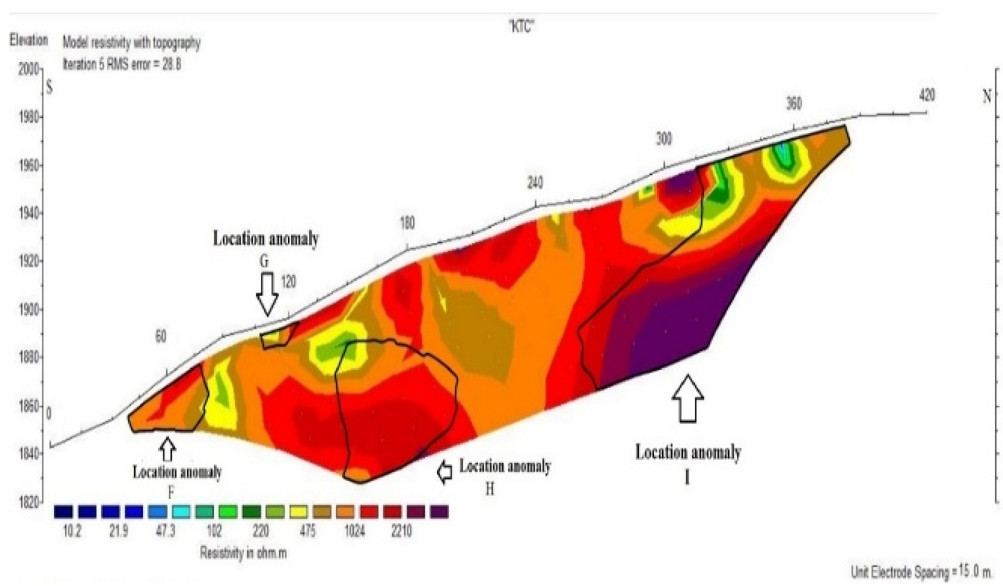

Figure 6. Resistivity cross-section obtained from inverse modeling of resistivity data with topography along the KTC survey line.

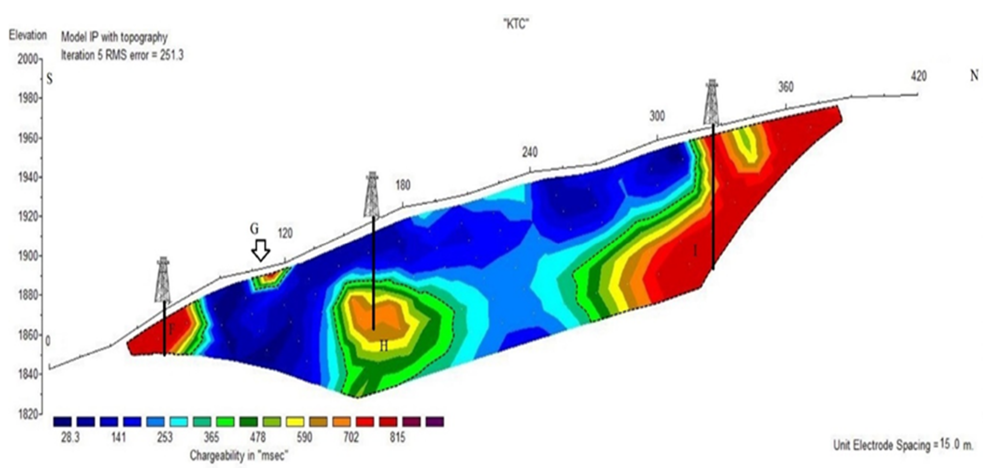

Figure 7. IP cross-section obtained as a result of inverse modeling of chargeability data with topography along the KTC survey line and suggested boreholes to access mineralization.

The geological cross-section along the KTC survey line passing various drilled boreholes is shown in Figure 8. In this geological cross-section, which has been obtained from the 1:20,000 geological map of the studied area, the electrical anomalies F, G, H and I (Figures 6 and 7) along the KTC survey line are also shown.

In order to validate the modeling results obtained along the KTC survey line, the analysis results of the samples taken from the boreholes BH-KBC11 and BH-KBC13 have been considered. The borehole BH-KBC11 is passed through the anomaly H at the depths of 20 m to 70 m, where the gold particles are confirmed in the anomaly. The borehole BH-KBC13 also passes the anomaly I from the ground surface to the depth of approximately 70 m. Figure 9 demonstrates a chart of the variations in gold concentration (in terms of ppm) at different depths in these two boreholes. According to this figure, the presence of a considerable amount of gold in the anomalies H and I (Figure 8), where crossing the boreholes BH-KBC11 and BH-KBC13, respectively, is confirmed.

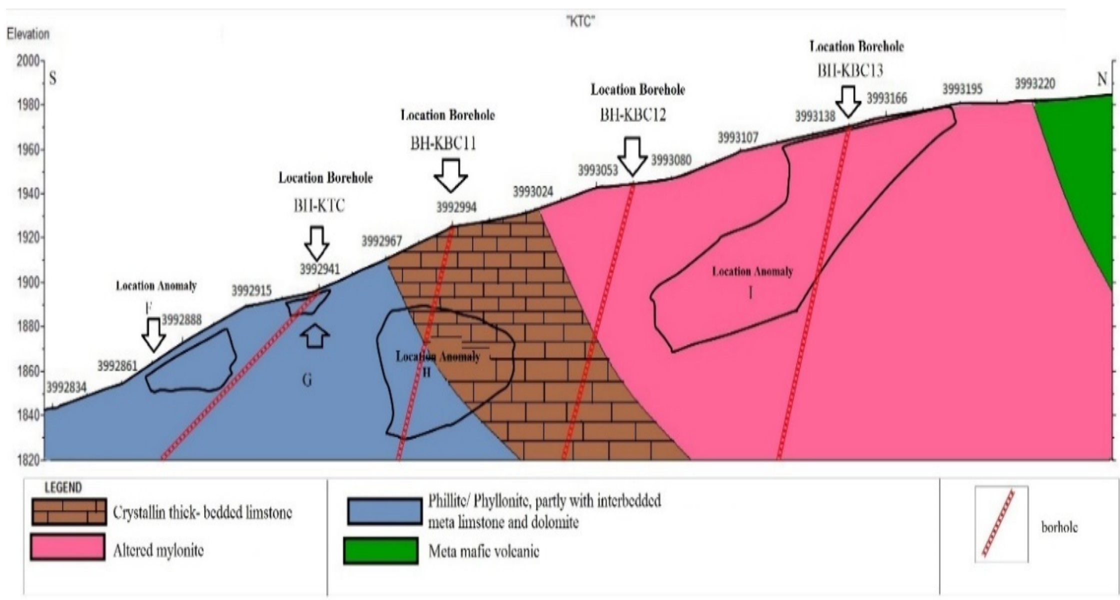

Figure 8. Geological cross-section along the KTC survey line and positions of different boreholes on it.

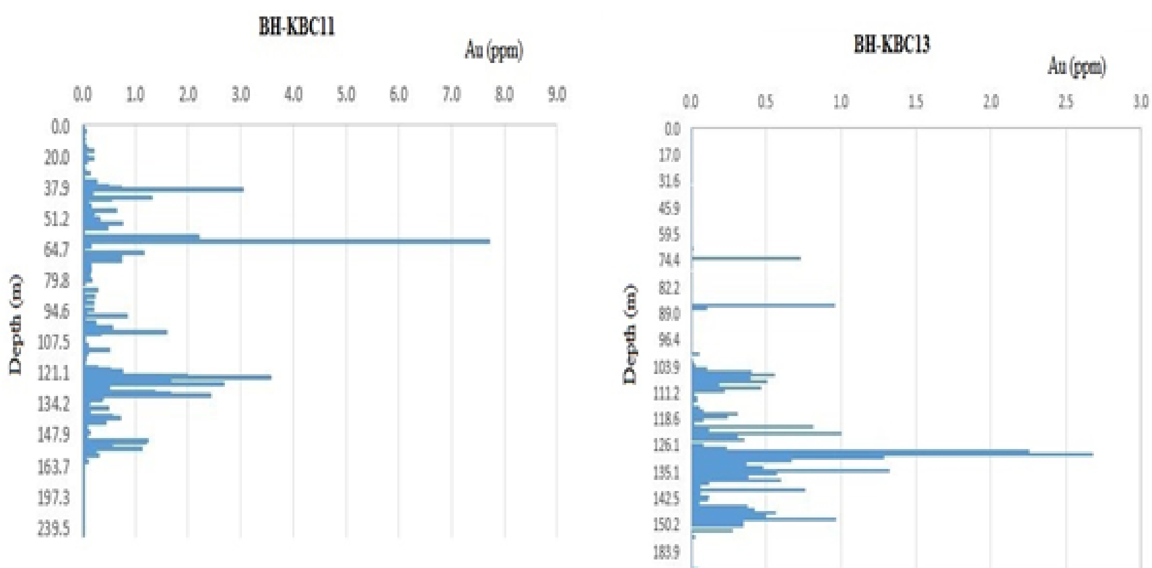

Figure 9. Variations in gold element concentration versus depth in the BH-KBC11 and BH-KBC13 boreholes.

5. Discussion and conclusions

In this work, the gold mineralization in shear zones in the Kervian area was investigated, considering that it may accompany sulfide minerals that often produce IP anomalies. The 2D modeling and interpretation of the acquired resistivity and IP data in the area were made, and as a result, the sub-surface geophysical anomalies were identified that may contain gold mineralization. In order to reduce the uncertainty in identifying gold mineralization, and to obtain a suitable exploration pattern or model for the gold deposit in the area, a combination of the geophysical data modeling and interpretation results with geological information and chemical analysis of the samples taken from the drilled boreholes in the area was used. In this paper, only the results of the IP and resistivity data modeling and interpretation along two survey lines, called the KTA and KTC survey lines, were shown.

Mineralization in the studied area occurs in the altered sulfide units. In addition to quartz, carbonates were observed accompanying sulphides, and had the largest expansion in the altered alkaline volcanic units. In this work, modeling and interpretation of the resistivity and IP data were carried out on two survey lines in order to determine the sub-surface areas of gold mineralization in the Kervian area, and as a result, the drilling points were suggested on these two survey lines, as described in Table 1. These drilling points are also shown in Figures 3 and 7. It is necessary to mention that the suggested drilling points are located on the zones having high IP values due to the presence of metallic mineral particles such as pyrite and gold. Thus, some of the suggested drilling points may not be necessarily associated with gold mineralization. However, the most important result of this work is the occurrence of IP anomalies, which exist in the phyllite (often schist) and carbonate units, and according to the validation results obtained using the drilled boreholes in this area, these IP anomalies are accompanied by a high concentration of gold (more than one gram per ton); however, the IP anomalies within the altered mylonite units lack the commercial gold concentration. Therefore, the IP anomalies that occur inside the phyllite and carbonate units are considered as the main anomalies, and for further exploration, these anomalies are in the top priority; however, the IP anomalies in the mylonite units considering uneconomic amount or low concentration of gold within them have lower economic value, and are given the second priority in the exploration program.

Table 1. Coordinates of the suggested points for drilling on the KTC and KTA survey lines.

Survey line name	Suggested borehole name	Depth of drilling	Drilling angle (degrees)	Longitude (UTM)	Latitude (UTM)
KTA	KTA-1	40	90	596959	3992962
KTA	KTA-2	75	90	596846	3993129
KTC	KTC-1	30	90	596701	3992888
KTC	KTC-2	60	90	596697	3992981
KTC	KTC-3	75	90	596719	3993133

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مدل اکتشافی یک کانسار طلا در منطقه کرویان استان کردستان ایران با استفاده از ترکیب نتایج ژئوفیزیکی با اطلاعات زمین‌شناسی و داده‌های اکتشافی دیگر

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چکیده:

از آنجایی که بسیاری از کانسارهای طلا با زون‌های سولفیدی همراه هستند و اکتشاف مستقیم کانسارهای طلا با استفاده از روش‌های ژئوفیزیکی، به دلیل اندک بودن مقدار طلا در زیر سطح زمین، بسیار دشوار است، اکتشاف مستقیم زون‌های سولفیدی با استفاده از روش‌های ژئوفیزیکی مقاومت ویژه الکتریکی و قطبش القایی (IP) ممکن است منجر به اکتشاف غیر مستقیم کانسارهای طلا شود. کانسار طلا در منطقه کرویان در پهنه برشی کردستان واقع شده است. تمرکز کانه‌زائی طلا در پهنه برشی کردستان با واحدهای دگرسانی سولفیدی، سیلیسی و کربناتی در ارتباط مستقیم می‌باشد. با توجه به شواهد کانی‌سازی در محدوده کرویان، پس از برداشت داده‌های مقاومت‌ویژه و IP، مدل‌سازی دوبعدی این داده‌ها به‌منظور مشخص کردن مناطق کانی‌سازی طلا در این منطقه انجام شد. چون برخی از بی‌هنجاری‌های ژئوفیزیکی شناسایی‌شده، نشان‌دهنده زون‌های سولفیدی هستند که ممکن است به همراه طلا در حد اقتصادی نباشند، به منظور به دست آوردن یک الگوی اکتشافی از کانسار طلا در منطقه مورد مطالعه، ترکیبی از نتایج مدل‌سازی و تفسیر داده‌های ژئوفیزیکی با اطلاعات زمین‌شناسی و داده‌های اکتشافی دیگر جهت کاهش عدم قطعیت در شناسایی زون‌های طلادار در ابن منطقه مورد استفاده قرار گرفته است. در نتیجه، مدل‌سازی و تفسیر داده‌های ژئوفیزیکی منجر به شناسایی بی‌هنجاری‌های زیرسطحی به عنوان محل‌های احتمالی کانی‌سازی طلا شده و سپس نقاط حفاری در این منطقه پیشنهاد شده‌است. با در نظر گرفتن مطالعات زمین‌شناسی و تجزیه شیمیایی نمونه‌های گرفته شده از گمانه‌های حفرشده که برخی بی‌هنجاری‌های ژئوفیزیکی را قطع کرده‌اند، ما نتیجه می‌گیریم که بی‌هنجاری‌های ژئوفیزیکی درون واحدهای فیلیت و کربناته در منطقه می‌توانند حاوی مقادیری طلا در حد اقتصادی باشند و بنابراین، به عنوان اولویت بالا برای اکتشافات بیشتر توصیه می‌شوند.

کلمات کلیدی: کانی‌سازی طلا، مقاومت ویژه الکتریکی، قطبش القایی، مدل‌سازی و تفسیر داده‌های ژئوفیزیکی ، کرویان.